

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/303323831>

Usability challenges in an Ethiopian software development organization

Conference Paper · May 2016

DOI: 10.1145/2897586.2897604

CITATIONS

0

READS

76

3 authors, including:



Yvonne Dittrich

IT University of Copenhagen

146 PUBLICATIONS 1,148 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:



Urban Data 2 Decide: <http://www.urbandata2decide.eu/> [View project](#)

All content following this page was uploaded by Yvonne Dittrich on 23 May 2016.

The user has requested enhancement of the downloaded file. All in-text references [underlined in blue](#) are added to the original document

and are linked to publications on ResearchGate, letting you access and read them immediately.

Usability Challenges in an Ethiopian Software Development Organization

Degif Teka
IT Doctoral Program,
Addis Ababa University
Addis Ababa, Ethiopia
degiftk@gmail.com

Yvonne Dittrich
Systems and Software Section,
IT University of Copenhagen
Copenhagen, Denmark
ydi@itu.dk

Mesfin Kifle
Department of Computer Science,
Addis Ababa University
Addis Ababa, Ethiopia
Kiflemestir95@gmail.com

ABSTRACT

Usability and user centered design (UCD) are central to software development. In developing countries, the gap between IT development and the local use situation is larger than in western countries. However, usability is neither well addressed in software practice nor at the policy making level in Ethiopia. Software practitioners focus on functional requirements, meeting deadlines and budget. The software development industry in Ethiopia is in its early stage. The article aims at understanding usability practices in an Ethiopian software development company. Developers, system analysts, product owners and users were studied. In this first phase of the research, participatory observation, a workshop and interviews with practitioners and operational staff were analyzed. Informal discussions have been observed to outweigh formal meetings for sharing experience and ideas. Practitioners' internal configuration, their experience, cultural knowledge and common sense regarding the users' situation guided the design. Prototypes and fast delivery of working versions helped in getting user feedback even if early user focus proved to be a challenge as communication between developers and users suffered from several layers of indirection. Further challenges are the heterogeneity of users to be supported, a lack of awareness of usability methods, and lacking resources.

Keywords

User focus; usability; ASDMs; UCD; agile team communication; product owner; operational staff; PC.

1. INTRODUCTION

For interactive systems, usability is utterly important. In Ethiopia in many cases, ICT and mobile services are leap frogging paper based administration. Especially in rural areas, part of the population is illiterate or semi-literate. Many can only afford low-end mobile phones. Usefulness and usability are of core importance for this part of the population to take advantage of ICT services.

Usability has been defined by Nielsen as a property of the user interface with the attributes efficiency, learnability, memorability, error free and subjectively pleasing [24]. The operational definition followed in this article is the widely used one given by ISO 9241-11, which defines usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" as cited in [19].

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from Permissions@acm.org.

CHASE'16, May 16 2016, Austin, TX, USA

© 2016 ACM. ISBN 978-1-4503-4155-4/16/05...\$15.00

DOI: <http://dx.doi.org/10.1145/2897586.2897604>

Usability and UCD are becoming more important in software development [6, 17, 23]. Software engineering methods like Agile Software Development Methods (ASDMs) are promising to integrate usability. However, there is not a straight forward way to do so. ASDMs are increasingly adopted in industry and also in Ethiopian software industry.

In countries like Ethiopia where ICT industry is not well established, there are additional problems such as economic resources and skills. Most of the software companies in Ethiopia are young and inexperienced [4][12]. Another challenge is that there is no formal education on usability and human computer interaction (HCI): the curriculum of higher institutions do not have even introductory course in this area. In August 2014, prior to the research presented here, an interview study was conducted with two interviewees from government IT organizations and two from private software companies. The analysis revealed that usability and UCD practices are considered important to address user needs but provide challenges for the practitioners.

This article reports on the initial phase of an action research study addressing the questions: How is usability addressed in the context of agile software development? And what are the specific challenges when addressing usability in an Ethiopian company?

The research presented here investigates usability practices and challenges in an Ethiopian company in the context of agile software development. The projects subject to the field study develop special purpose applications of mobile services connecting rural communities to the capital. They are designed for two different organizations, with different customers and users, geographically separated, speaking different local languages and culture. One of the application is for the northern region of Ethiopia, while the other is developed for the southern region of Ethiopia. However, the two projects have similarities in the application domain and, to a large extent, share the same code base.

The next section discusses related work. Section 3 details the research methods applied. The detail of the research is presented in the section 4. The discussion in section 5 relates the issues encountered in section 4 to the issues in the related work and that way develops the contribution of the research. The conclusion summarizes the findings.

2. RELATED WORK

Latest with the introduction of personal computers in the 70ties, usability and HCI have become an issue for software engineering and made their way into the curriculum in many European and North American universities. With the diversification of the research discourses though, the integration of software engineering and HCI maintained a disputed area. The related research section first discusses software development in the

contents of ICT and development. The few articles that are published on the topic indicate the need of iterative development to accommodate user participation and the use of early prototypes to finalize the design. As agile development is one of the recommended approaches and many of the companies in Ethiopia and also the case company use ASDMs, we present the state of the art on agile development and usability.

The discussion in the ICT for development (ICT4D) community focuses very much on the design, implementation and use of ICT in developing contexts. The research in this area has acknowledged that not only the design results need to take cultural specificities into account, but also the design methods have to be adjusted to the specific context [31]. The same is proposed for software engineering [4] and HCI [30]. The software development process is by and large ignored. An exception is an article by Doerflinger and Dearden [15] on “Evolving a software development methodology for commercial ICTD projects, Information Technology and International Development”. The authors proposed a close collaboration and cooperation between project stakeholders involving multiple parties, emphasizing a systematic approach to study end users using local personnel instead of relying on researchers who are new to the local community. The agile approach they propose combines evolutionary and iterative development and the reflective action research of the researchers that generates input and feedback for the design. They emphasize that every project has a unique makeup in terms of scope, use situation, IT skills, availability of resources and other contextual factors that have to be taken into account when setting up the software engineering project. The necessity of an iterative process and explicit user focus has also been documented in a case study on two projects by Pade-Khene *et al.* [25]. Sustainability of such projects depends on that the projects are community driven, initialized with pilot projects in the community, and iterative and incremental in design and development to help identify the requirements and challenges for the community (users).

Dörflinger and Dearden propose ASDMs as a starting point to integrate user participation and feedback when developing ICTD applications. The use of ASDMs is also wide spread in the Ethiopian IT sector. ASDMs are flexible, iterative and incremental methods focusing on customer collaboration, individual interactions and responding to changes [2, 10]. There are many success factors identified for software development organizations with ASDMs [22, 9].

The main focus of agile processes is how to organize the required tasks in a flexible way to reach at the overall goal of delivering working software [3, 27]. Project management, team organization, design and coding techniques are organized to support flexibility and adaptive planning. While delivering working software is a required condition of usable systems, ASDMs focus more on efficient coding; usability issues might be ignored as an explicit user-centered focus is lacking [5].

The focus on engineering and project management aspects of ASDMs can prevent an orientation towards UCD [5]. In many of the methods, an on-site customer is expected to represent the users' perspective when asked to elaborate on the user stories and implementing acceptance tests. However the customer may not know the needs of the actual users and could be from a different organization than the actual users are. Moreover, none of the major ASDMs explicitly incorporates usability-engineering practices. This ‘blind spot’ also becomes visible in the systematic literature review (SLR) on empirical research on agile

development: Dyba and Dingsøyr [16] presented systematic review of empirical works in agile software development up until the year 2005. Their report indicated that agile software development is increasingly adopted. Furthermore, their review indicated code quality, developer satisfaction, the increased cooperation with the customer, and customer satisfaction. They have indicated that empirical studies in this area remain scarce and called upon more empirical investigations. However, they do not mention the end user engagement, and do not problematize that the on-site customer is rarely the end user. A follow up study by partly the same authors [11] states that quality and quantity of research on agile methods increased. The authors summarize research contributions about appropriateness of agile methods, adaptations and reconciliations of agile methods. Again, user centered design in agile methods is not mentioned.

Addressing usability and hence user involvement has several advantages for software development [20]. Flexible ways of addressing user needs are crucial for software companies who exist in a competitive market. UCD and hence user involvement is important when developing useful and usable software. Dittrich and Lindeberg, report that the involvement of users in software development in combination with control of schedules and budget is possible and improves the software [13]. A systematic literature study indicates that the participation of users has demonstrable advantages [1].

The case study by Hansson *et al.* [18] shows that flexible development practices can successfully facilitate active user involvement. A combination of UCD techniques and agile approaches is possible as has been reported by Chamberlain *et al.* [8]. In their examination of professional practice based on interviews of UCD practitioners involved in agile software development, the authors reported that ASDMs have a distinct culture that at first glance seems to conflict with UCD [21]. However they also report that the use of agile methods can result in improved usability.

In two recent SLRs, the research on the combination of UCD and ASDM has been summarised. Salah *et al.* [26] report that agile methods suffer from lack of allocated time for system design and user research. Some studies propose upfront design though extensive upfront design and planning is considered as waste in agile development and is against the agile values and principles. Salah *et al.*, therefore, recommended for the close collaboration between the development team and designer. The SLR also indicated some of the usability testing methods that could be carried out in agile development. Brhel *et al.* [7] looked into the current state of user centered agile development (UCASD). In the studies they reviewed, usability work relies on the team members' own initiative and understanding, user involvement by and large takes place in an ad hoc manner. The study proposes five principles related to processes and practices of software development and recommends future research in this area should look into people, social and technological aspects for UCASD. The open issue up until to date is who should be responsible for usability and quality requirements: usability specialist or a cross functional team. The authors require a clear definition of who are the users in the scrum agile method and to clearly place the responsibility for usability and for the quality of the products.

The analysis and discussion presented below is thus dealing with two sets of issues: the general challenge to combine UCD and ASDMs and the specific challenges of doing so in a developing country. The challenges of integrating usability and UCD into ASDMs mentioned in the literature are: lack of early and

continuous focus on users, developers aiming at meeting deadlines and budget and, hence, developers considering usability as something that could be addressed later in development if time permits, lack of clear definition of the user perspective, lack of awareness of usability by developers and managers, lack of organizational support and also that ease of use and futurity, the ability of the product to support evolving needs, are not considered [6, 29, 7]. Software development in the developing countries is characterized by low infrastructure, lack of manpower and technical problems or knowledge. This goes hand in hand with a lack of the ICT knowledge by the majority of users of IT products. In addition, developing countries like Ethiopia suffer from the lack of HCI education and trained HCI practitioners. This is reflected in a lack of awareness on the policy making level, as for example the procurement and acquisition processes in Ethiopia do not consider usability as a criteria. As already discussed above, the culture in developing countries might require different ways of product development that fit the cultural context [31, 4, 30].

3. METHOD

The research has been carried out in a young private software company, which is actively involved in the software development in Ethiopia. The company mainly develops Software as a Service (SaaS) including products for public private partnership (PPP) but also contract projects for specific customers. In addition to the PPP projects with giant public organizations in Ethiopia, it is also oriented towards digital financial support of the rural people.

The research presented here is part of a PhD study focusing on integrating usability and UCD into agile methods inspired by cooperative method development (CMD) [14], an action research approach combining qualitative empirical research with software engineering method improvement. The research reported here is meant to inform the deliberation and implementation of improvements in cooperation with practitioners involved in the development process.

The first author has been involved from the beginning of the projects, observing and documenting the software development practice two days per week in the company in order to understand the actual software development practice and usability challenges. Additionally, the research consisted of initial interviews with developers, the product owner responsible for the project, and an operational officer supporting the deployment of an early version, attending project meetings, and observing and interviewing operational staff and users in the rural area. As recording of the meetings was not possible, the analysis relies on field notes. One workshop with software developers, product owner and operational officer has been carried out in addition to the observation. Initial analysis has been done identifying issues that are meant to inform future action research. This initial phase has been performed starting from December 2014 to June 2015.

4. AGILE DEVELOPMENT IN AN ETHIOPIAN SOFTWARE COMPANY

This section presents the initial analysis and the findings from the empirical research. We start with describing the development process and presenting the development team. The following sub section then presents the findings regarding contact with the users and customers. The section concludes with identifying related challenges.

The purpose of the observed projects is to provide services for rural communities that connect them to the center. This implies

that there are heterogeneous users who are geographically dispersed, speaking different languages, with different cultures and hence usability matters. The project team is composed of roles product owner, three developers (software engineers), project manager / scrum master and two operational officers (i.e. product training officers). Operational officers are responsible for deploying successive versions at the users' site, training users, and communicating users' challenges to the developers and the product owner. Due to the non-disclosure agreement (NDA), we are not able to disclose the application domain and functionality of the system.

4.1 The Development Process and Artifacts

The projects considered for this research are ongoing contract projects and have been implemented using an adaptation of SCRUM, one of the most widely used agile development approach.

Upon agreement with clients, the product owner and operational officers visited the client site for detailed discussion and presentation of the company profile and experience particularly related to the project. The operational officers are both bachelor degree graduates in business and marketing. They learnt to work with software practitioners and users through experience. Both operational officers and product owner met users and customers at the customer site for interviews, observation and documentation of the as is situation to gain an understanding of the domain knowledge during the initial period. The operational officers' role is later to train users, to follow up with users on their challenges and to report to project manager and product owner. The product owner (PO) used paper sketches and other tools for eliciting further requirements. During the succeeding periods the PO got comments, challenges, request for change and other requests from the operational staff who collected field data and user support requests. The IT support personnel were recruited and trained during the first deployment as detailed in section *user contacts*. They were meant to support the rural users but turned out to operate the system on behalf of the actual end users who are farmers and chair men of farmer cooperatives.

The product owner working with the project has a master degree in economics. She is an experienced IT user and learnt the technicalities of how to work with software practitioners through meetings and experience. The PO developed the requirements that form the product backlog and continuously enhanced and prioritized the product backlog. The backlog is recorded in a table format. User stories are captured in the form of paper sketches as shown in figure 1 or as graphs represented on a spreadsheet. The PO then discussed with developers on the requirements, prepared user stories, time estimate for each user story as shown in table 1, similar to sprint backlog and sprint planning. User stories are prepared in collaboration between the programmers, the project manager (scrum master) and the PO. User stories are assigned to team members based on their preference and expertise. Three software engineers (SE1, SE2 and SE3) were involved in the projects. Sprint planning meetings took place once every sprint before the start of the sprint. The PO prepared requirements in ways understandable for both developers and customers as for example shown in figure 2.

A sprint usually takes three weeks but sometimes may go on for up to a month. After the sprint planning meeting, the PO follows up on the progress. The PO and developers have frequent contact. The meetings are sometimes initiated by the PO and sometimes by the developers in order to clarify questions regarding the

functionality of the system. These meetings are not regular or scheduled. The developer team, PO and operational staff all have their offices on the same floor.

A sprint ends with sprint review meeting which also includes the sprint retrospective. Usually, the PO and the team participate in these meetings. The PO verifies the completeness of the user stories for the sprint. The team and the PO discuss what went well, what the challenges were and what has to be improved in the successive sprints. After delivery, the team, the project manager/scrum master, the operational officer and the PO meet and discuss the issues with the deployment of the software.

Product	<input type="text"/>	Summary
Variance	<input type="text"/>	100 quintal Yield1 variant 2
Quality	<input type="text"/>	280 quintal Yield2 variant 3
Amount	<input type="text"/>	50 quintal Yield3 variant 4

Figure 1. Sample Interface design by the PO

Table 1. Sample user stories for the mobile application

User stories	Estimate (hour)	Responsible
Add Loading/Unloading interface to the mobile application. fields required(type, variety, quality, amount, driver name, driver's phone number, truck's plate number, destination point, distance from or to (...) (in km), transportation fee (only when unloading)	16 hrs	SE1
The Loading/unloading interface should also have date and time stamp. It should also have the option to edit or delete.	8 hrs	SE1
Add Address(location) information of PC at the back end web application	8 hrs	SE3
Create database table for loading/unloading	8 hrs	SE2
Add SMS service to transfer the loading/unloading data to the server	16 hrs	SE2
Send SMS notification for the driver The message should include the total amount of crops delivered, date and time, and the pickup/destination point	8 hrs	SE2
Build test data repository	8 hrs	SE3

4.2 The Development Team

The development team is collocated in the same room, where they can easily turn around and help each other on any development issues or challenges. Two of the team members have a bachelor degree in computer science, one of them and the project manager

have master degree in computer science. All developers in the case company have a minimum of either bachelor or master degree in computer science or information systems. Usually, different teams work with a number of projects and there is often not a one to one match between teams and projects. Team members may be moved from one project to another if necessary. Not all projects, especially not the offshore projects, are implemented using agile development, as the practice is not yet mature.

Internally, the PO represents the customer and tries to follow up the progress of the project, clears the doubts of the developers. The PO keeps contact with customers for any additional requirements or change of requirements. On top of this, the team also receives information about the user and use context from operational staff.

The project manager acts as a scrum master. He follows up on the progress of the development team, discusses any obstacles and guides the junior team members. The scrum master also interacts with the PO during the project for change requests and new requirements approval.

Total purchase (in Birr) per primary cooperative (PC)

PC	6-Oct-14	13-Oct-14	20-Oct-14	27-Oct-14
PC1	23069	19258	36123	48001
PC2	16500	26300	25000	32012
PC3	18900	13600	15200	26985
PC4	15838	17500	38695	26036
PC5	56369	25856	86756	49856

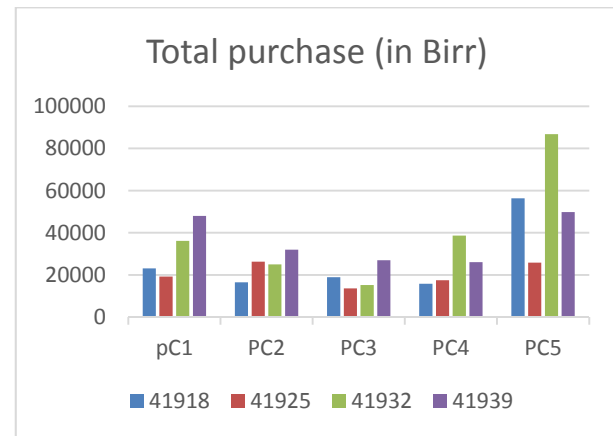


Figure 2: Sample material supporting user stories

4.3 User Contacts

The system is meant to be used by different kinds of users: The back-end system will be used by well-educated staff at the headquarters and the warehouses of the customer. The mobile application interfacing with the system is meant to be used by transport agents and IT support personnel and farmers in the rural Ethiopia. The initial contact between PO and the customer also included interaction with the users at the headquarters and the warehouses.

The contact to rural users first took place after deploying a first version of the application. 'User training' then was offered by

operational personnel to the support personnel, who were recruited to support the introduction and initial usage at the countryside. These IT supporters have a 3 year education related to IT. The IT supporters ended up operating the system on behalf of the users due to the lack of IT skills and lack of high end mobile phones in the rural communities. Each such IT supporter interacts closely with a so-called core farmer who is a member and contact person of the primary farmers' cooperative (PC). The IT supporters upload data into the system on market days i.e. when transactions take place, accompanying the PC to the places where crops is collected and loaded onto a lorry to the regional hub. A PC has several members supplying agricultural yield to be collected. During the pilot phase, the system is used in about 10 PCs in the southern project and 5 PCs in the northern project. The assumption is that in the future the PCs themselves will learn how to operate the system. Training for the IT supporters on how to use the mobile app was offered by training officers, or operational personnel. The IT supporters operating the mobile app cooperated with the PC in recording data and performing the transactions mainly on market days. Usually, there are two market days per week in one location. There can be more than one market at the same day in different locations.

The operational staff reports bugs, user challenges and additional requirements discovered during the training to the project manager and product owner. The IT support staff work with the PCs and reflect the PC's feedback and requirements. The first version is the result of the first sprint of the development process. The operational staff also logs the support calls from users and IT supporters at working days from Monday to Friday.

The interview with the operational personnel revealed that after the deployment of the first version, user respectively IT supporters recorded a number of challenges: understanding the terminology on the interfaces; need of customized report generation which is specific to each IT supporter's PC, for example, to let the user view only suppliers to the specific PC; the difficulty of understanding application generated error messages; and the need of language support i.e. Amharic for the northern project. The challenges were communicated to the operational personnel on her visit to the field to receive comments after deployment on the northern project. The operational officer visits the field usually once per month i.e. when a new version is deployed, interacts with users and discusses their challenges. The PO visits the user sites to discuss with users about their challenges and to gather additional requirements to later discuss with the client. Additional requirements and change of requirements are communicated and logged and considered on the next sprints.

For the development team the PO represents the users, both the corporate users and the farmers' cooperatives. She communicates the needs of users and also proposes concrete interface sketches. She also gives comments on the interface the developers designed with respect to its ease of use. The PO uses the interface design for her discussions with development team. In most cases, it has been observed that the PO follows up meeting deadlines and the fulfillment of the functional requirements as with the development team.

4.4 Usability Challenges

During the process a number of challenges for usability and functionality has been encountered. In a half day workshop held in the case company's office involving participants from the developers, product owner and operational staff, the observed challenges were listed and complemented by the participants. The

list of challenges was prioritized for further action. The challenges range from difficulties with public infrastructure, like mobile network and electricity in the rural setting, to the interface design of the application.

An example for usability issues caused by the lacking telecommunication infrastructure is raised by the IT support staff. The mobile app communicates with the server via SMS messages. This problem has two sources: not only is the mobile network is not always available in the rural area but also the messaging platform of the company happens to fail to operate. The central example for UI related challenges are language localizations and the understandability of error messages.

According to the participants, the most important challenge is related to the development process: the lack of prioritization of usability issues due to the focus on functionality and on meeting deadlines and budget, lack of practice for usability testing and the long chain of representations between end users and developers. Another highly prioritized challenge was raised by the scrum master: "We developers need single point of contact". He complained that product owners and operational staff have user contacts and talk about requirements to the developers. Proper way of communicating usability requirements to the team was also raised as one of the challenges. An additional development related problem is that developers are assigned to several projects at the same time. Often a specific project is paused and the developers work on other projects.

These challenges need the understanding and cooperation of the management and the project members. The next step is to work for action and improvement in the next development phases.

5. DISCUSSION

In line with the related work on UCD and agile development [6, 21, 29], the initial research presented above confirms that it is not straight-forward to integrate both methods, though the iterations in ASDMs open up for including user feedback into the development. Developing software for users in rural Ethiopia increases the challenge.

Though developers and users are living in the same country, the distance and difference between software developers in the capital and users in rural communities is difficult to bridge. Additionally, the IT skills and literacy level of the intended users provide challenges not only for the communication about the functionality but also for the usage of the early versions. As a result, we observed a chain of intermediaries between the intended users and the development team. As using the early versions turned out difficult due to the lack of high-end mobile phones and IT skills of the intended users, the software provider recruited IT support staff. The IT supporters used the software on behalf of the intended users. With other words, the intended users are represented by proxy users. These representatives then provided the 'user feedback' for the team. The operational staff and the product owner further translated this feedback to the team, but they also represented other stakeholders and the central customer for the project. This turned out to be confusing for the team as the scrum master complained: 'I need a single point of contact about user challenge reports'.

An interesting observation though is that for the team, the feedback by proxy users, customer representatives and the PO all was talked about as user feedback. Further, in the discussions, the heterogeneity of users connected through the service was not reflected in the way the team talked about 'the user'. This can turn

into a problem: Rather than relating to concrete users with concrete difficulties, ‘the user’ might become a ‘scenic feature’ [28] in the discussion of the team. In the projects observed by Sharrock and Anderson the real users were not involved. Sharrock and Anderson [28] conclude their investigation of how the designers referred to the user: “However, this does not mean that the user were not present in the designing. ... we want to say that ‘the user’ was a ‘scenic feature’ of the design process in that what users would want, what they might do, what they would be willing to accept were treated as significant and sometimes even decisive” [28, p. 11]. The issue, though, is that if the assumptions about ‘the user’ are not realistic, usefulness and the usability of the product suffer.

The difficulty of representation of the heterogeneous user groups that became visible in our fieldwork as well as the developers’ use of informal and common sense representation of user needs has also been mentioned in [7]; the user perspective is of an ad hoc nature in an agile-scrum project requiring clear definition of user perspectives. The literature study further requests future research in the area of the social aspects of user centered agile development working in other domains like organizational science and sociology.

Given these initial observations and the discussion of at the workshop, a number of challenges become visible: First, how can the rural communities as intended users be included in the design of complex IT services? Though of utter importance, this question lies outside the research presented here; it would constitute a PhD thesis in its own rights. Interested readers might refer e.g. to [31] or to the article by Zewge *et al.* [32] with respect to the Ethiopian context. Second, how can the intended users and their input or feedback be represented as comprehensive and as authentic as possible for the development team? Third, how can the heterogeneity and diversity of users and use situations of complex IT services be represented for the development team in a way that allows the developers to take in the right usability input at the right time? Fourth, how to coordinate the cooperation between the development team, the PO and the staff at the operational offices of the company?

Inspiration on how to organize close cooperation and collaboration of users can be taken from Dörflinger and Dearden: local change agents who are familiar to the users’ situation and who can act as intermediaries to communicate user challenges and use situation to the developers; the use of presentation of context related knowledge like process descriptions, scenarios and personas has been proposed by Doerflinger and Dearden [15].

However, the challenge regarding the coordination and cooperation between the development team, the PO and the operational staff and also other challenges listed in the section ‘Usability Challenges’ makes visible that a solution requires not only changes to the development processes, methods and tools, but also organizational support for usability as a central quality.

The next phase of this research aims at proposing solutions to the observed challenges, implementing them together with the practitioners and observing the improvements in practice.

6. CONCLUSION AND FUTURE RESEARCH

In a country like Ethiopia where its IT services are leap-frogging paper based administration, usability is of utter importance.

We started out by raising the research questions: How is usability addressed in the context of agile software development in Ethiopia? And what are the challenges regarding usability in a typical Ethiopian company?

The results can be summarized as follows: Usability and user-centered design are not addressed in any systematic manner in the observed projects but relies on common sense of the involved practitioners. Usability issues are gathered based on the deployment of a first version. As the use of the mobile applications turned out to be cumbersome, the company employed IT supporters using the software on behalf of the actual users. The feedback of these supporters provided the main feedback regarding usability of the software. On the side of the SCRUM team, the heterogeneous user groups are not distinguished. The danger here is that the user becomes a ‘scenic feature’ rather than a concrete person with specific skills and challenges,

Based on our fieldwork and a workshop together with the project members and managers of the company, we identified and prioritized a number of challenges when addressing usability. One of the questions to be addressed in future research is to what extent the challenges are a result of agile development not taking heed of usability issues and to what extent the challenges are due to the specific conditions of software engineering in a developing country context. In many cases both causes might contribute: ‘normal’ problems of integrating UCD in ASDMs are aggravated due to the specific circumstances. The fieldwork indicates that normal usability challenges are emphasized due to literacy level, technical skills and access to high-end mobile phones of part of the intended users. Different local languages and lacking telecommunication infrastructure require additional technical considerations. It is less clear how the cultural context affects the software development. That management prioritizes functionality and budget, feedback on usability issues is not systematically communicated to the developers, or the need to work with several projects in parallel impairs the intention to emphasize usability resembles very much findings from the developed world. Also that the feedback by the intended users is filtered through a long chain of ‘representatives’ might to some extent be also observable in other contexts but, like the usability issues, is aggravated due to the heterogeneity of users and the distance of the situation of users and the situation of the developers. The next steps in the action research will help to understanding to which extend the challenges are specific for the Ethiopian context: How methods are adopted and adapted reflects on both, the method as well as the challenges, which they are meant to address.

The beginning action research explores the use of personas and other representations of the users and their contexts. Such representations could address the difficulty to design for heterogeneous user groups and could support the understanding of the users and their situation by the PO and the development team. The challenge here is not only to introduce the work with personas, but also to adapt their usage to the agile development in the company. Discount usability practices like heuristic evaluation and other light-weight usability evaluation methods that take into account the local context will be explored.

7. ACKNOWLEDGMENTS

We would like to thank our collaborating company for its support and cooperation. Thanks to the development team and operational and support personnel for their openness and participation. We also would like to thank the reviewers for their supportive and constructive criticism.

8. REFERENCES

- [1] Abelein, U. and Paech, B. 2015. Understanding the Influence of User Participation and Involvement on System Success—a Systematic Mapping Study. *Empirical Software Engineering*, 20(1), 28-81.
- [2] Agile Alliance. Manifesto for Agile Software Development. 2001, Available: <http://www.agilealliance.org>, Accessed on March 2015.
- [3] Beck, K. 2000. *Extreme Programming Explained: Embrace Change*. Addison-Wesley.
- [4] Biru, T. 2008. *Reflective Steps: A Collaborative Learning Oriented Approach to Software Development and Process Improvement*. Doctoral Thesis. Universität Hamburg.
- [5] Blomkvist, S. 2005. Towards a model for bridging Agile development and user-centered design. In *Human-Centered Software Engineering—Integrating Usability in the Software Development Lifecycle*. pp. 219-244, Springer Netherlands.
- [6] Boivie, I. Aborg, C. Persson, J. and Lofberg, M. 2003. Why usability gets lost or usability in in-house software development. *Interacting with Computers* 15(5): 623–639.
- [7] Brhel, M. Meth, H. Maedche, A. and Werder, K. 2015. Exploring principles of user-centered agile software development: A literature review. *Information and Software Technology*. 61 (2015) 163–181, Elsevier B.V.
- [8] Chamberlain, S. Sharp, H. and Maiden, N. 2006. Towards a framework for integrating Agile development and user-centered design, In *Extreme Programming and Agile Processes in Software Engineering*, pp. 143-153, Springer Berlin Heidelberg.
- [9] Chow, T. and Cao, D. 2007. A survey study of critical success factors in agile software projects. *The Journal of Systems and Software*, 81(6), 961-971.
- [10] Cockburn, A. 2002. *Agile Software Development*, Addison-Wesley.
- [11] Dingsoyr, T, Nerur, S, Balijepally, V, and Moe, N. 2012. A decade of agile methodologies: Towards explaining agile software development, *Journal of Systems and Software*. 85(6), 1213-1221.
- [12] Dino, H. 2012. *A Framework for Integrating Software Usability Into Software Development Process*. Masters Thesis, HiLCoE School of Computer Science & Technology.
- [13] Dittrich, Y. and Lindeberg, O. 2003. How use-oriented development can take place. *Information and Software Technology* 46.9 (2004): 603-617, Elsevier.
- [14] Dittrich, Y. Rönkkö, K. Eriksson, J. Hansson, C. and Lindeberg, O. 2008. Cooperative method development. *Empirical Software Engineering*. 13(3), 231-260.
- [15] Doerflinger, J. and Dearden, A. 2013. Evolving a software development methodology for commercial ICTD projects. *Information Technology and International Development*. 9 (3), 43-60.
- [16] Dyba, T. and Dingsøy T. 2008. Empirical studies of agile software development: A systematic review, *Inform. Softw. Technol.*, doi:10.1016/j.infsof.2008.01.006.
- [17] Goransson, B. Gulliksen, J. and Boivie, I. 2003. The Usability Design Process – Integrating User-centered Systems Design in the Software Development Process. *Softw. Process Improve. Pract.*, 2003; 8: 111–131.
- [18] Hansson, C. Dittrich, Y. and Randall, D. 2004. Agile Processes Enhancing User Participation for Small Providers of Off-the-Shelf Software. *XP 2004, LNCS 3092*, pp. 175–183, Springer-Verlag.
- [19] Jokela, T. Iivari, N. Matero, J. and Karukka, M. 2003. The Standard of User-Centered Design and the Standard Definition of Usability: Analyzing ISO 13407 against ISO 9241-11, *CLHC '03: Proceedings of the Latin American conference on Human-computer interaction*. (pp. 53-60). ACM.
- [20] Kujala, S. 2003. User involvement: a review of the benefits and challenges. *Behav Inform Technol*. 22(1), 1-16.
- [21] McInerney, P. and Maurer, F. 2005. UCD in Agile Projects: Dream Team or Odd Couple? *Interactions*. 12(6), 19-23.
- [22] Misra, S. Kumar, V. and Kumar, U. 2009. Identifying some important success factors in adopting agile software development practices. *The Journal of Systems and Software*. 82 (2009). 1869–1890, Elsevier.
- [23] Nebe, K. Zimmermann, D. and Paelke, V. 2008. Integrating Software Engineering and Usability Engineering. in *Advances in Human Computer Interaction*. Pinder S. InTech. 2008, PP. 331-350.
- [24] Nielsen, J. 1993. *Usability Engineering*. Academic Press.
- [25] Pade-Khene, C. Mallinson, B. and Sewry, D. 2011. Sustainable rural ICT project management practice for developing countries: investigating the Dwesa and RUMEP projects, *Information Technology for Development*, 17:3, 187-212, DOI: 10.1080/02681102.2011.568222, Routledge Taylor & Francis group.
- [26] Salah, D, Paige, R, and Cairns, P. 2014. A systematic literature review for agile development processes and user centered design integration. In *Proceedings of the 18th International Conference on Evaluation and Assessment in Software Engineering*. (p. 5). ACM.
- [27] Schwaber, K. and Beedle, M. 2002. *Agile Software Development with Scrum*. Prentice Hall.
- [28] Sharrock, W. and Anderson, B. 1994. The user as a scenic feature of the design space. *Design Studies*. 15(1), 5-18.
- [29] Silva, S. T. Martin, A. Maurer, F. and Silveira, M. 2011. User-Centered Design and Agile Methods: A Systematic Review. In *AGILE*(pp. 77-86).
- [30] Smith, A. Bannon, L. and Gulliksen, J. 2010. Localising HCI practice for local needs. *Proceedings of the 2010 international conference on Interaction Design & International Development*. British Computer Society.
- [31] Winschiers-Theophilus, H. 2009. Cultural Appropriation of Software Design and Evaluation. In: Whitworth, *Handbook of Research on Socio-Technical Design and Social Networking Systems*. IGI Global
- [32] Zewge, A. Dittrich, Y. and Bekele, R. 2014. Software designing methodology for ICT4D domain. *Proceedings of the 13th Participatory Design Conference: Short Papers, Industry Cases, Workshop Descriptions, Doctoral Consortium papers, and Keynote abstracts-Volume 2*. ACM.